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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,850	11/22/2000	Ramachandra Divakaruni	BUR9-2000-0016-US1	3171

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FREDERICK W. GIBB, III  
MCGINN & GIBB, PLLC  
2568-A RIVA ROAD  
SUITE 304  
ANNAPOLIS, MD 21401

EXAMINER

GEBREMARIAM, SAMUEL A

ART UNIT PAPER NUMBER

2811

DATE MAILED: 01/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/718,850

Applicant(s)

DIVAKARUNI ET AL.

Examiner

Samuel A Gebremariam

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 15 November 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 7-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because in figure 3 reference numeral 20 is indicating to a base layer and reference numeral 16 is indicating to a nitride layer. This is not consistent with figures 1 and 2. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Specification***

2. The disclosure is objected to because of the following informalities: on page 2 and line 3 of the specification the word "has" appears to have a typographical error. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 5, 7-18 and 20, are rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund US patent No. 5,087,580 in view of Peidous US patent No. 6,001,700 and in further view of Blair US patent No. 5,904,536.

Regarding claim 1, Eklund teaches a method (figs. 2-8) of forming an emitter in a vertical bipolar transistor comprising: providing a substrate (16) having a collector layer (26 and a base layer 48 over the collector layer; forming a patterned mask over the

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base layer and filling the opening in the mask with emitter material where the emitter material contacting the substrate.

Eklund fails to disclose i) a collector layer and the base layer formed by implantation through a single mask formed on the substrate, ii) filling the opening in the mask with emitter material using damascene process and iii) filling more than one opening.

Peidous teaches forming base and collector of a bipolar transistor by implantation using a single masking step on a substrate (col. 1, line 63-, col. 2, line 25).

Blair teaches (col. 2, lines 57-67) the use of damascene process for forming a self-aligned polysilicon emitter in the process of forming a bipolar transistor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the single masking step of forming the base and collector of the bipolar transistor in the process of Eklund in order to reduce the number of photoresist ion implant masking steps (col. 2, lines 1-4). Furthermore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the damascene process taught by Blair in to the combined process of Eklund and Peidous in order to form the emitter of the bipolar transistor since damascene process eliminates the need for over etching of epitaxial silicon in the base region because the process is selective to polysilicon over epitaxial silicon.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to make more than one opening and filling the openings in the

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mask with emitter material since the formation integrated circuit involves the fabrication of more than one bipolar transistor.

Regarding claim 2, Eklund teaches substantially the entire process steps of claim 1 above including the substrate includes an insulator layer (10) between the bottom silicon layer and a top silicon layer (16), the method further comprising implanting a first impurity to form the collector layer (26) in a lower portion of the top silicon layer adjacent the insulator layer and implanting a second impurity to form the base layer (48) in an upper portion of the top silicon layer (figs. 2-8).

Regarding claim 5, Eklund teaches substantially the entire process step of claim 1 above including forming a protective layer (74) over the emitter and implanting additional amounts of the first impurity into and through the insulator layer to provide a collector contact diffusion region 76 (fig. 8).

Regarding claims 11, 7-10, and 12-17, Eklund teaches substantially the entire process steps of claims 1-5 above including the method of simultaneously forming CMOS devices and vertical bipolar transistor on an integrated circuit chip comprising: providing a silicon a silicon over insulator substrate having a collector layer (26) and a base layer (48) over the collector layer; forming a gate oxide layer (44) only the CMOS region of the SOI substrate, forming a polysilicon layer (46) of the CMOS region of the SOI substrate patterning a mask over the polysilicon layer and the bipolar region of the SOI substrate, the mask including openings (54) over the bipolar region; depositing an emitter material to form emitters; removing the mask; patterning the polysilicon layer to

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form gate conductor (62) and forming sidewall spacers (74) adjacent the emitter and the gate conductors (figs. 2-8).

Regarding claim 18, Eklund teaches (figs. 2-8) substantially the entire claimed process of claims 1-17 above including a bipolar device on a SOI substrate having a semiconductor layer (16) overlying buried layer insulator (10) to form an interface where a surface of the semiconductor layer is adjacent to a surface of the buried insulator, comprising the steps of forming in the semiconductor layer a buried collector region (26) centered at approximately the interface and forming in the semiconductor layer a base region vertically stacked on the buried collector region.

Regarding claim 20, Eklund teaches substantially the entire process steps of claims 18, 1 and 3 above including forming a mask having opening (54) on the SOI substrate and depositing an emitter material contacting the SOI substrate (26) having a first impurity in the opening to form an emitter (60).

Claim 3, is rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund in view of Blair in view of Miwa et al. US patent No. 5,352,624.

Regarding claim 3, Eklund teaches substantially the entire process step of claim 1 above including first impurity emitter diffusion region (61) in the base below the emitter 60.

Eklund does not teach explicitly the method of claim 2 further comprising annealing the vertical bipolar transistor to drive the first impurity into the base to create an emitter diffusion region in the base below each emitter.

Annealing the vertical transistor to drive impurities into the base to create an emitter diffusion region is a conventional process and is also taught by Miwa in the process of manufacturing a bipolar transistor structure (fig. 20I, col. 39, line 63-, col. 40, line 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the conventional annealing process the process of Eklund in order to speed the diffusion process.

Claim 4, is rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund, Peidous, Blair and in view of Horie US patent No. 5,406,113.

Regarding claim 4, Eklund teaches substantially the entire process steps of claim 1 above except explicitly stating that the method of claim 2 further comprising: patterning a second mask over the bipolar region the mask including openings through to the base layer between one of the emitter and implanting additional amounts of the second impurity into the base layer through the openings.

It is conventional to form openings by patterning a masking layer and also taught by Horie (Horie, figs 3a-3g) with reference to bipolar structure since such structures are readily used for forming impurity regions that are subsequently used for metallization purposes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implant impurity in the structures taught by Horie in the process of Eklund in order to reduce contact resistance between base region and base electrode.

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***Response to Arguments***

4. Applicant's arguments with respect to claims 1-5 and 7-18 have been considered but are moot in view of the new ground(s) of rejection.

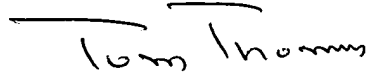
***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel Admassu Gebremariam whose telephone number is 703 305 1913. The examiner can normally be reached on 8:00am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 305-7646. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Samuel Admassu Gebremariam  
January 17, 2003

  
TOM THOMAS  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800